Department of Theoretical and Applied Mechanics
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Mr. Wm. A. Greene, SC-NsG-434, Supplement No. 1/14-05-010
Grants and Research Contracts
National Aeronautics and Space
Administration
1925 Florida Avenue, N. W.
Washington, D. C. 20546

SUBJECT: STATUS REPORT

Title : Line Integrals, Surface Integrals, Volumes, Centroids, and Moments of Inertia of a Class of Shells of Revolution and for a Larger Class of Shells

Period: July 1 through December 31, 1965

[redacted]

PROGRESS:

During the above period two reports were prepared as follows :

"A Method of Determining an Optimum Shape of a Class of Thin Shells of Revolution" by
Morris Stern, Han-chung Wang and Will J. Worley
July, 1965 50 pages

"Tables of Natural Frequencies and Nodes of Transverse Vibration of Tapered Beams" by
Han-chang Wang and Will J. Worley
December, 1965 76 pages

The first report above required substantially longer to complete than anticipated because of the difficulty of establishing a suitable logic for the convergence of the digital computer solution.

The second report above while not required under the grant; resulted as auxiliary information collected by Dr. Han-chung Wang while preparing his doctoral dissertation. Hence, with very little additional effort, it was possible to achieve the vibrational characteristic of beams having corss-sectional areas defined by the equation

$$\left|\frac{x}{a}\right|^{\alpha} + \left|\frac{y}{b}\right|^{\beta} = 1 \qquad (1)$$

which is under study.

While work has continued during the past year and one half on the determination of the deflections of clamped plates having an exterior boundary defined by Eq. (1), a report has not been completed to date because the program has not permitted solution in the range from $\alpha = 1$ to $\alpha = 2$. Solutions for the range $\alpha = 2$ to $\alpha = 10$ have been

[redacted]

successfully programmed. An effort is being made to establish the reasons for the current failures within the program. However, an approximate method of mapping is being applied in a complex variable approach to the problem. Work on the energy approach is continuing because it will permit the large deflection behavior of the plate to be established.

An auxiliary project, which makes use of the training of an undergraduate student who has engaged in programming Eq. (1), involves a study of the characteristics of the equation

$$\left|\frac{x}{a}\right|^{\alpha} - \left|\frac{y}{b}\right|^{\beta} = 1 \qquad (2)$$

which corresponds to the hyperbolic type equation symmetric about the x-axis and in particular when $\alpha = 1$ it corresponds to the parabolic type equation also symmetric about the x-axis. Both cases pass through a minimum value of the x-coordinate at $x = a$ in the right half plane. Such shapes are of interest as energy collectors either radiated by man made signals or by the sun or other stars.

[redacted] possible application, where the sun is the energy source, is the collection of energy for cooking food and for heating water, particularly in the depressed areas of the world such as India.

The last mentioned project does not detract from the progress on the other phases of the work required under the grant. Further, it shows promise of producing valuable results.

No inventions have resulted from this research effort during the above period.

Submitted by

Will J. Worley

Will J. Worley
Principal Investigator

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